Plant Physiol. (1989) 89, xxvi–xxix
0032-0889/89/89/xxvi/04/$01.00/0

# Author Index


**A**

Abeles, Fred B., 664
Abernethy, Rollin H., 569
Ahluwalia, Kiran Jit K., 1158
Akazawa, Takashi, 1024
Akimitsu, Kazuya, 925
Albersheim, Peter, 421
Allan, Deborah L., 823
Alliotte, Thierry, 743
Almon, Helmar, 1035
Alvarez, Rafael, 439
Anderson, James D., 138
Andre, Marcel, 61
Andreo, Carlos S., 280
Apte, Shree K., 204
Arold, Norbert, 1088
Arora, Rajeev, 1372
Avissar, Yael J., 852
Avron, Mordhay, 1258

**B**

Badger, Murray R., 37, 44, 51
Bailey, Doreen, 238
Ballaré, Carlos L., 1324
Barton, Kenneth A., 564
Baskin, Tobias I., 493
Baumgartner, Brian J., 1011
Beachy, Roger N., 111
Beale, Samuel I., 852
Bedford, Ian D., 1279
Beechey, R. Brian, 669
Beevers, Harry, 1006
Beloeil, Jean-Claude, 19, 27
Below, Frederick E., 341
Bender, Jürgen, 1299
Benedict, Chauncey R., 506
Bergman, Birgitta, 783
Berkowitz, Gerald A., 753, 1358
Berlin, Jochen, 488, 1299
Bettey, Mary, 1279
Bidwell, R. G. S., 93
Biggs, M. Scott, 117
Binns, Mary Elizabeth, 387
Black, Clanton C., 1106, 1117
Blevins, Dale G., 1331
Böger, Peter, 1035
Bohnert, Hans J., 811, 817
Bollini, Roberto, 1079
Boss, Wendy F., 126
Boswell, Richard T., 1238
Bouton, Joseph H., 839
Bowyer, John R., 674
Boyer, John S., 798
Brauer, David, 464, 867
Briggs, Winslow R., 293, 493
Brosio, Paul, 776
Brower, Dorothy P., 501
Brown, R. Harold, 839
Brownell, Peter F., 539
Brummett, Donald L., 941
Brunk, Dennis G., 1161
Buchanan, Bob B., 1270
Buchheim, Julie A., 768
Burger, David W., 165
Burtin, Daniel, 104
Bush, Daniel R., 1318
Butz, Nola D., 735
Byerrum, Richard U., 305

**C**

Caboche, Michel, 86
Callahan, Franklin E., 707
Callis, Judy, 1275
Camilleri, Patrick, 674
Campell, Bruce R., 1337
Canny, Martin J., 1094
Canvin, David T., 498, 1213
Caplan, Allan, 743
Cardon, Zoe G., 1253
Castillo, Federico J., 159
Chamber, Manuel, 78
Chang, Keejong, 197, 1275
Chapman, Kent D., 352
Chaudhari, Panna, 1366
Chen, Pei-Chung, 1035
Chen, Qiuyun, 126
Chen, Yih-Ming, 617
Cheng, Shu-Hua, 1129
Chiles, Lisa A., 879
Chou, Mei, 617
Chrispeels, Maarten J., 845
Christou, Paul, 564
Chueca, Ana, 381
Church, Daniel F., 879
Clark, Robert A., 963
Clarke, Adrienne E., 360
Cleland, Robert E., 250
Cohn, Marc Alan, 879
Cojocaru, Miriam, 1028
Colburn, Susan M., 768
Conn, Eric E., 472
Copeland, Laura F., 805
Cosgrove, Daniel J., 184
Cote, François Xavier, 61
Coté, Gary G., 724
Crain, Richard C., 724
Croteau, Rodney, 1351
Cummins, W. Raymond, 325

**D**

Daguenet, Alain, 61
Darvill, Alan, 421
Darwen, Christopher W. E., 658
Dawson, A. P., 888
Dean, Bill B., 1021
de Boer, Albertus H., 250
De-Eknamkul, Wanchai, 429
de Felipe, María R., 381
Dekker, Eugene E., 1122
Delhaize, Emmanuel, 700
del Río, Luis A., 728
De Wit, Pierre J. G. M., 945
Dharmawardhane, Suranganee, 1345
Dhindsa, Rajinder S., 375
Dick, Arthur J., 1394
Dilley, David R., 805
Dillon, Patrick F., 805
Dobres, Michael S., 833
Doehlert, Douglas C., 1042
Doong, Rong-Luh, 10
Drøbak, B. K., 888
Dumbroff, Erwin B., 1053
Dunn, Linda J., 664
Dunn, Michael F., 5
Dunsmuir, Pamela, 776
DuPont, Frances M., 1, 1401

**E**

Edwards, Gerald E., 280, 1129
Eguchi, Hiromi, 643
Einspahr, Kregg J., 970
Eising, Rainer, 1000
Ellis, Brian E., 429
Elthon, Thomas E., 1311
Engler, Gilbert, 743
Espie, George S., 1213
Etani, Shuichi, 634

**F**

Fara, Angela, 69
Farrell, Harold M., Jr., 501
Faye, Loïc, 845
Fernández, Víctor M., 728
Ferreira, Paulo, 602
Fett, William F., 5
Feyerabend, Martin, 692
Flores, Hector E., 512
Fock, Henrich P., 1213
Folliot, Michel, 61
Fondy, Bernadette R., 396, 403
Fong, Franklin, 1039
Foster, Michael A., 506
Fountain, David W., 333
Fredeen, Arthur L., 225
Friedman, Alan L., 993
Friedman, Haya, 530
Fry, Stephen C., 883
Fuchs, Yoram, 138

**G**

Gage, Douglas A., 1039
Galston, Arthur W., 512
Gamble, H. Ray, 138
Garbarino, Joan, 1
Gee, Robert, 305
Geiger, Donald R., 396, 403
Gerber, Dennis, 305
Gerhardt, Bernt, 1000
Gershenzon, Jonathan, 1351
Gibbs, Martin, 1158
Gijzen, Mark, 260
Gillet, Brigitte, 19, 27
Goldschmidt, Eliezer E., 530, 1028
Goldschmidt-Clermont, M., 15
Goliber, Thomas E., 732
Gorge, Julio L., 381
Gorton, Holly L., 387
Gottlieb, Hugo E., 1028
Goudey, J. Stephen, 1306
Gow, Neil A. R., 1198
Goyal, Arun, 958, 1264
Greenblatt, Gerald A., 506
Gremaud, Maureen F., 169
Grof, Christopher P. L., 539
Gross, Kenneth C., 477
Grothe, Dieter, 1172
Grubišić, D., 1085
Guern, Jean, 19, 27

Plant Physiol. (1989) 89, xxvi–xxix
0032-0889/89/89/xxvi/04/$01.00/0

# Author Index


**A**

Abeles, Fred B., 664
Abernethy, Rollin H., 569
Ahluwalia, Kiran Jit K., 1158
Akazawa, Takashi, 1024
Akimitsu, Kazuya, 925
Albersheim, Peter, 421
Allan, Deborah L., 823
Alliotte, Thierry, 743
Almon, Helmar, 1035
Alvarez, Rafael, 439
Anderson, James D., 138
Andre, Marcel, 61
Andreo, Carlos S., 280
Apte, Shree K., 204
Arold, Norbert, 1088
Arora, Rajeev, 1372
Avissar, Yael J., 852
Avron, Mordhay, 1258

**B**

Badger, Murray R., 37, 44, 51
Bailey, Doreen, 238
Ballaré, Carlos L., 1324
Barton, Kenneth A., 564
Baskin, Tobias I., 493
Baumgartner, Brian J., 1011
Beachy, Roger N., 111
Beale, Samuel I., 852
Bedford, Ian D., 1279
Beechey, R. Brian, 669
Beevers, Harry, 1006
Beloeil, Jean-Claude, 19, 27
Below, Frederick E., 341
Bender, Jürgen, 1299
Benedict, Chauncey R., 506
Bergman, Birgitta, 783
Berkowitz, Gerald A., 753, 1358
Berlin, Jochen, 488, 1299
Bettey, Mary, 1279
Bidwell, R. G. S., 93
Biggs, M. Scott, 117
Binns, Mary Elizabeth, 387
Black, Clanton C., 1106, 1117
Blevins, Dale G., 1331
Böger, Peter, 1035
Bohnert, Hans J., 811, 817
Bollini, Roberto, 1079
Boss, Wendy F., 126
Boswell, Richard T., 1238
Bouton, Joseph H., 839
Bowyer, John R., 674
Boyer, John S., 798
Brauer, David, 464, 867
Briggs, Winslow R., 293, 493
Brosio, Paul, 776
Brower, Dorothy P., 501
Brown, R. Harold, 839
Brownell, Peter F., 539
Brummett, Donald L., 941
Brunk, Dennis G., 1161
Buchanan, Bob B., 1270
Buchheim, Julie A., 768
Burger, David W., 165
Burtin, Daniel, 104
Bush, Daniel R., 1318
Butz, Nola D., 735
Byerrum, Richard U., 305

**C**

Caboche, Michel, 86
Callahan, Franklin E., 707
Callis, Judy, 1275
Camilleri, Patrick, 674
Campell, Bruce R., 1337
Canny, Martin J., 1094
Canvin, David T., 498, 1213
Caplan, Allan, 743
Cardon, Zoe G., 1253
Castillo, Federico J., 159
Chamber, Manuel, 78
Chang, Keejong, 197, 1275
Chapman, Kent D., 352
Chaudhari, Panna, 1366
Chen, Pei-Chung, 1035
Chen, Qiuyun, 126
Chen, Yih-Ming, 617
Cheng, Shu-Hua, 1129
Chiles, Lisa A., 879
Chou, Mei, 617
Chrispeels, Maarten J., 845
Christou, Paul, 564
Chueca, Ana, 381
Church, Daniel F., 879
Clark, Robert A., 963
Clarke, Adrienne E., 360
Cleland, Robert E., 250
Cohn, Marc Alan, 879
Cojocaru, Miriam, 1028
Colburn, Susan M., 768
Conn, Eric E., 472
Copeland, Laura F., 805
Cosgrove, Daniel J., 184
Cote, François Xavier, 61
Coté, Gary G., 724
Crain, Richard C., 724
Croteau, Rodney, 1351
Cummins, W. Raymond, 325

**D**

Daguenet, Alain, 61
Darvill, Alan, 421
Darwen, Christopher W. E., 658
Dawson, A. P., 888
Dean, Bill B., 1021
de Boer, Albertus H., 250
De-Eknamkul, Wanchai, 429
de Felipe, María R., 381
Dekker, Eugene E., 1122
Delhaize, Emmanuel, 700
del Río, Luis A., 728
De Wit, Pierre J. G. M., 945
Dharmawardhane, Suranganee, 1345
Dhindsa, Rajinder S., 375
Dick, Arthur J., 1394
Dilley, David R., 805
Dillon, Patrick F., 805
Dobres, Michael S., 833
Doehlert, Douglas C., 1042
Doong, Rong-Luh, 10
Drøbak, B. K., 888
Dumbroff, Erwin B., 1053
Dunn, Linda J., 664
Dunn, Michael F., 5
Dunsmuir, Pamela, 776
DuPont, Frances M., 1, 1401

**E**

Edwards, Gerald E., 280, 1129
Eguchi, Hiromi, 643
Einspahr, Kregg J., 970
Eising, Rainer, 1000
Ellis, Brian E., 429
Elthon, Thomas E., 1311
Engler, Gilbert, 743
Espie, George S., 1213
Etani, Shuichi, 634

**F**

Fara, Angela, 69
Farrell, Harold M., Jr., 501
Faye, Loïc, 845
Fernández, Víctor M., 728
Ferreira, Paulo, 602
Fett, William F., 5
Feyerabend, Martin, 692
Flores, Hector E., 512
Fock, Henrich P., 1213
Folliot, Michel, 61
Fondy, Bernadette R., 396, 403
Fong, Franklin, 1039
Foster, Michael A., 506
Fountain, David W., 333
Fredeen, Arthur L., 225
Friedman, Alan L., 993
Friedman, Haya, 530
Fry, Stephen C., 883
Fuchs, Yoram, 138

**G**

Gage, Douglas A., 1039
Galston, Arthur W., 512
Gamble, H. Ray, 138
Garbarino, Joan, 1
Gee, Robert, 305
Geiger, Donald R., 396, 403
Gerber, Dennis, 305
Gerhardt, Bernt, 1000
Gershenzon, Jonathan, 1351
Gibbs, Martin, 1158
Gijzen, Mark, 260
Gillet, Brigitte, 19, 27
Goldschmidt, Eliezer E., 530, 1028
Goldschmidt-Clermont, M., 15
Goliber, Thomas E., 732
Gorge, Julio L., 381
Gorton, Holly L., 387
Gottlieb, Hugo E., 1028
Goudey, J. Stephen, 1306
Gow, Neil A. R., 1198
Goyal, Arun, 958, 1264
Greenblatt, Gerald A., 506
Gremaud, Maureen F., 169
Grof, Christopher P. L., 539
Gross, Kenneth C., 477
Grothe, Dieter, 1172
Grubišić, D., 1085
Guern, Jean, 19, 27

Guinn, Gene, 941
Guy, Charles L., 444
Guy, Robert D., 1150

H

Halevy, Abraham H., 530
Hallahan, Beverly J., 674
Hampp, Rüdiger, 1088, 1172
Handa, Avtar K., 117
Harper, James E., 169
Harris, Gary C., 368
Harris, Philip J., 360
Harrison, Marcia A., 652
Hase, Toshiharu, 1193
Hashimoto, Haruki, 1178
Havaux, Michel, 286
Havir, Evelyn A., 952
Heath, Robert L., 159
Helm, Kenneth, 569
Hermoso, Rosario, 381
Herrin, David, 100
Hershberger, Wilbur L., 664
Hickok, Leslie G., 535
Hills, Matthew J., 1006
Holdsworth, Jacqueline M., 333
Holzwarth, James A., 681
Homeyer, Uwe, 1388
Hooks, Mark A., 963
Howard, Joy, 674
Hsu, An-Fei, 464
Huber, Steven C., 518
Huber, William E., 839
Huchzermeyer, Bernd, 1388
Huffaker, Raymond C., 220
Huner, Norman P. A., 144
Hurley, David, 391
Husic, H. David, 897, 904
Hylton, Christopher M., 982

I

Inzé, Dirk, 743
Ireland, Robert J., 192
Irvine, R. F., 888
Ishii, Tadashi, 421
Ishikawa, Takayuki, 180

J

Jackson, Paul J., 700
Jäger, Hans J., 1299
Jarrell, Wesley M., 823
Jeffrey, Martha, 133
Jenkins, Colin L. D., 1231
Jensén, Paul, 1380
Jensen, Roy A., 10
John, Philip, 658
Johnston, Mark, 539
Jones, Karen L., 879
Jones, Michael W., 238
Joosten, Matthieu H. A. J., 945
Joussaume, M., 416
Joy, Kenneth W., 192

K

Kaderbhai, Mustak A., 669
Kaderbhai, Naheed, 669
Kaplan, Aaron, 1220
Kato, Yoji, 792
Kaufman, Lon S., 544
Kawakami, Naoto, 910
Keegstra, Kenneth, 993
Ketchum, Karen A., 1184
Kimata, Yoko, 1193
Kitano, Masaharu, 643
Kitayama, Masahiko, 897, 904
Knobloch, Otto, 786
Kobza, John, 174, 918
Kodama, Hiroaki, 910
Kohmoto, Keisuke, 925
Komamine, Atsushi, 910
Komiyama, Seiichi, 712
Konjević, R., 1085
Krall, John P., 280
Krol, Marianna, 144
Ku, Maurice S. B., 1129
Kuehn, Glenn D., 525
Kurkdjian, Armen, 19, 27
Kuroki, Gary W., 472

L

Labavitch, John M., 1394
Ladror, Uri S., 151
LaFavre, Adrienne K., 875
LaFayette, Peter R., 299
Lallemand, Jean-Yves, 19, 27
Lander, D. J., 888
Larcher, Walter, 740
Laroche, Andre, 144
Laskowski, Marta J., 293
Lauer, Michael J., 1331
Laurière, Christiane, 244
Layzell, David B., 498
Lázaro, Juan J., 381
Lecharny, A., 416
Lee, Wen-Jane, 932
Leopold, A. Carl, 875, 977
Lerner, Miriam, 1220
Letcher, A. J., 888
Letham, David S., 74
Leto, Kenneth J., 1141
Li, Quanning, 211
Lin, Chu-Yung, 617
Lindblad, Peter, 783
Litek, Knut, 1388
Lujan, Leah D., 700
Lundberg, Peter, 1380

M

Ma, Yong-Ze, 586
Ma, Yong-Zhan, 597
MacAdam, Jennifer W., 549
Macdonald, Fraser D., 1270
MacKown, Charles T., 457, 597
Madhavan, Soundararajan, 506
Maffei, Massimo, 1351
Maissan, Ellen E., 144
Malnoë, P., 15
Mandel, Roger, 269
Manigault, Jeanne, 19, 27
Manigault, Pierre, 19, 27
Manuel, Livingston J., 897
Marcussen, Jan, 1071
Markwell, John, 238
Martin-Tanguy, Josette, 104
Massimino, Daniel, 61
Masuda, Hiroshi, 712
Mathieu, Yves, 19, 27
Matoh, Tōru, 180, 1102
Matsuoka, Makoto, 316
Matsuura, Chie, 634
Matthews, Mark A., 264
Mattoo, Autar K., 707
Mawson, Bruce T., 325
Mayak, Shimon, 165
Mayor, Guy, 622
McCully, Margaret E., 1094
McDougall, Gordon J., 883
McGregor, Ian, 260
McHale, Neil A., 952
McIntosh, Lee, 1311
McTavish, Hugh, 452
Megnegneau, Beatrice, 86
Mehrle, Werner, 1172
Mehta, Roshni A., 707
Merriam, Kathleen, 368
Meurer-Grimes, Barbara, 488
Meyer, Christiane, 692
Michaels, Allan, 100
Michalowski, Christine B., 811, 817
Miginiac, Emile, 86
Miller, Andrew L., 1198
Miller, Anthony G., 1213
Minamikawa, Takao, 276
Mitcham, Elizabeth J., 477
Mitsuhashi, Wataru, 276
Miyoshi, Yasuhiro, 687
Mohapatra, Shyam S., 375
Moore, Brandon d., 1129
Moriyasu, Yuji, 687
Moroney, James V., 897, 904
Morris, Kristin L., 904
Morris, Paul F., 10, 498
Morse, M. J., 724
Mott, Keith A., 1253
Mullet, John E., 1011
Murata, Takao, 316
Murillo, Jesús, 78
Murphy, Denis J., 1006
Musgrave, A., 888
Myscich, Elizabeth G., 144

N

Nakamoto, Hitoshi, 316
Naton, Beatrix, 1172
Nelson, Curtis J., 549
Nešković, Mirjana, 1085
Neuhoff, Volker, 1088
Neuner, Gilbert, 740
Nevins, Donald J., 792
Ng, Timothy J, 477
Ngernprasirtsiri, Jarunya, 1024
Nickels, Roxy L., 1311
Nieman, Richard H., 963
Nishimura, Syoyo, 925
Nissen, Per, 231
Nissen, Scott J., 439
Nonami, Hiroshi, 798
Nothnagel, Eugene A., 211

O

Obendorf, Ralph L., 610
Ohlrogge, John B., 707
Ohsugh, Ryu, 316
Ohta, Daisaku, 1102
O'Keefe, Daniel P., 1141
Olsen, Carl E., 1071
Olson, Steven W., 811
Oren-Shamir, Michael, 1258
Otani, Hiroshi, 925
Outlaw, William H., Jr., 1088
Outred, Heather A., 333

P

Palma, José M., 728
Palta, Jiwan P., 1372

Parker, Karen, 493
Paynot, Michel, 104
Pearce, David, 482
Peeler, Thomas C., 970
Peleman, Johan, 743
Pelese, Florence, 86
Peltier, Gilles, 762
Pengelly, William L., 1337
Perras, Michel, 577
Pesci, Pierantonio, 1226
Peters, Janny L., 159
Petersen, Nancy S., 569
Peterson, Camille C., 602
Pfeffer, Philip E., 1238
Pharis, Richard P., 269, 482
Phillips, Gregory C., 525
Piazza, George J., 501, 681
Pick, Uri, 1258
Pickard, Barbara G., 652
Picorel, Rafael, 452
Piepenbrock, Mechtild, 811
Pier, Paul A., 1358
Pilet, Paul-Emile, 622
Pontis, Horatio G., 648
Poole, Ronald J., 375, 1184
Possingham, John Victor, 1178
Prescott, Henry E., Jr., 893
Price, G. Dean, 37, 44, 51
Prioul, J. L., 416

R

Radin, John W., 264
Rajagopal, Ranganatha, 1071
Rajashekar, C. B., 1031
Ranch, Jerome P., 768
Randall, Douglas D., 1207
Randall, Stephen K., 1292
Rao, I. Madhusudana, 225
Rapp, Jeffrey C., 1011
Rawsthorne, Stephen, 982
Reddy, Bontha R., 204
Reid, Michael S., 165
Reinero, Antonio, 111
Rey, Pascal, 762
Reyss, A., 416
Rhodes, David, 1161
Rich, Patrick J., 1161
Rincón, Magaly, 126
Rise, Moshe, 1028
Roberts, Justin K. M., 197, 963, 1275
Robinson, Nigel J., 700
Rochaix, J.-D., 15
Rocher, J. P., 416
Rodriguez-Garay, Benjamin, 525
Rolin, Dominique B., 1238
Rood, Stewart B., 269, 482
Roper, Teryl R., 1136
Rossin, Nadia, 104
Roy, Harry, 1366
Rubinstein, Bernard, 1345
Rufty, Thomas W., Jr., 457
Ruiz-Argüeso, Tomás, 78
Rupérez, Francisco L., 728

S

Saab, Imad N., 610
Sage, Rowan F., 590
Sainis, Jayashree K., 368
Salerno, Graciela L., 648
Salmenkallio, Marjatta, 1285
Sánchez, Rodolfo A., 1324
Sandalio, Luisa M., 728
Sarhan, Fathey, 577
Sato, Fumihiko, 986
Satter, Ruth L., 724
Saugy, Martial, 622
Saxena, Abha, 138
Scherer, Siegfried, 1220
Schmitt, Jürgen M., 811, 817
Schuller, Kathryn A., 1207
Schultz, Gernot, 1388
Scopel, Ana L., 1324
Seemann, Jeffrey R., 174, 590, 918, 1060
Séguin-Swartz, Ginette, 260
Seibert, Michael, 452
Sen Gupta, Ashima, 753, 1358
Serafini-Fracassini, Donatella, 69
Servaites, Jerome C., 396, 403
Sharkey, Thomas D., 590, 735, 1060, 1066
Sharma, Rameshwar, 860
Shigematsu, Yoshio, 986
Shih, Ching Yu, 1053
Shrier, Alvin, 1184
Sicher, Richard C., 557
Sieciechowicz, Konrad A., 192
Sierzputowska-Gracz, Hanna, 1331
Singh, Jasbir, 144
Singh, Santokh, 74
Singletary, George W., 341
Sloan, Margaret E., 1341
Slocum, Robert D., 512
Sloger, Charles, 1238
Smeekens, Sjef, 1270
Smith, Alison M., 982, 1279
Smith, Ronald G., 93
Smyth, Douglas A., 893
Soffer, Hillel, 165
Sopanen, Tuomas, 244, 1285
Sossountzov, Lucienne, 86
Sotta, Bruno, 86
Sovonick-Dunford, Susan A., 184
Spalding, Martin H., 133
Spencer, Mary S., 1306
Staswick, Paul E., 309
Stayton, Mark M., 776
Steffen, Kenneth L., 1372
Stephenson, Martha B., 970
Stern, Arthur I., 1345
Sternberg, Leonel O'R., 839
Stitt, Mark, 628
Strack, Dieter, 488
Sturtevant, Dawn B., 1247
Su, Ling-Yuan, 1337
Subbaramaiah, Kotha, 860
Sugawara, Shiro, 712
Sültemeyer, Dieter F., 1213
Sun, Gongqin, 238
Sung, Shi-Jean S., 1106, 1117
Sutter, Ellen G., 439
Sze, Heven, 1292

T

Taiz, Lincoln, 391
Takabe, Tetsuko, 1024
Takahashi, Eiichi, 180, 1102
Takeshige, Kazuhiko, 1049
Taller, Barbara J., 1247
Tarczynski, Mitchell C., 1088
Tazawa, Masashi, 1049
Terry, Norman, 225
Thiel, David S., 569
Thomas, Christopher E., 464
Thomas, Jerry, 421
Thomas, Joseph, 204
Thomas, Roderick G., 333
Thompson, Guy A., Jr., 970
Thompson, John E., 1053
Thompson, Marvin P., 501
Thompson, William F., 833
Thornber, J. Philip, 602
Tirè, Christine, 743
Tischner, Rudolf, 220, 786
Tittle, Forrest L., 1306
Togasaki, Robert K., 897, 904
Tolbert, N. Edward, 305, 897, 904, 958, 1264
Torrigiani, Patrizia, 69
Travis, Robert L., 299
Trelease, Richard N., 352
Tu, Shu-I, 464, 867, 1238
Tucci, Michelle A., 403
Turley, Rickie B., 352
Turpin, David H., 409, 1150

U

Ulvskov, Peter, 1071
Unger, Erica A., 719

V

Vainstein, Alexander, 602
van Huystee, Robert B., 1299
Vanlerberghe, Greg C., 1150
Van Montagu, Marc, 743
Van Sanford, David A., 597
Vasconcelos, Aurea C., 719
Vassey, Terry L., 347, 1066
Velasco, Patricia J., 220
Verbeke, Judith A., 602
Villa, Ana, 78
Vitale, Alessandro, 1079
Vivó, Amparo, 381
Vogel, Hans J., 1380
Volenec, Jeffrey J., 549
Volk, Richard J., 457

W

Walbot, Virginia, 1275
Walker, Joan L., 518
Wang, Hong, 434
Warne, Thomas R., 535
Warpeha, Katherine M. F., 544
Wasserman, Bruce P., 1341
Watanabe, Akira, 910
Watson, Bruce A., 250
Webster, Cecelia, 1275
Weger, Harold G., 409
Weich, Rainer G., 1380
Weiler, Elmar W., 692
Weinhandl, Jodie A., 360
Weinstein, Leonard H., 512
Wenzel, Carol L., 1094
Whitaker, John R., 220
Whitmarsh, John, 932
Willeford, Kenneth O., 1158
Williams, John P., 144
Williams, Larry E., 1136
Williams, Paul H., 482
Williams, Robert J., 977
Williams, William E., 387
Winter, Harry C., 1122
Witte, Ludger, 1299
Wolfraim, Lawrence, 375
Wolk, William D., 805
Woodson, William R., 434
Wray, Victor, 1299

Wu, Jingrui, 1129

X

Xu, Dian-Peng, 1106, 1117

Y

Yamada, Yasuyuki, 986
Yasuoka, Sumito, 1102
Yelenosky, George, 444
Yen, Lung-Fei, 586
Yoshida, Shizuo, 634

Z

Zeevaart, Jan A. D., 1039
Zielinska, Teresa, 19
Zielinski, Raymond E., 151
Zoppè, Monica, 1079

Plant Physiol. (1989) 89, xxx–xxxix
0032-0889/89/89/xxx/$01.00/0

# Subject Index

A

Abscisic acid
biosynthesis in isolated corn embryos, 1039
correlation with photon fluence rate, leaf morphology, *Hippuris vulgaris*, 732
endogenous, growing maize roots, light effects, 622
-induced proline, potassium chloride, barley leaf segments, 1226
naphthaleneacetic acid-tolerant tobacco mutant, hormonal characterization, 86
red light and calcium, gravitropism, corn, 875
*Acer pseudoplatanus* (*see* Sycamore)
Acid invertase, light/dark profile, sugar beets, 347
Acridine orange, temperature effect on plasma membrane, tonoplast ATPases, barley root, 1401
Actin, myosin and, pea tendrils, 586
Acyl carrier protein, rapid acylation, exogenous fatty acids, *Spirodela oligorrhiza*, 707
Adenosine triphosphatase
tonoplast
phenylalanine uptake, barley vacuoles, 1388
temperature effect, barley root, 1401
vanadate-sensitive proton transport, kinetic analysis, maize root microsomes, 464
vanadate sensitivity, phospholipid requirement in maize roots, measurement methods, 867
Adenosine triphosphate
actin and myosin, pea tendrils, 586
biosynthesis, oat tonoplast, 1292
collapse of pH gradient by sodium ions, membrane vesicles, *Atriplex gmelini*, 180
inorganic carbon uptake, *Dunaliella tertiolecta* chloroplasts, 1264
plasma membrane, osmoregulatory mechanism, *Dunaliella salina*, 1258
ADP glucose pyrophosphorylase
genetic variability, differing growth rate, maize plants, 416
*rb* locus, enzymes of starch synthesis, pea embryos, 1279
Agmatine, polyamines and, HPLC analysis, plant tissue, 512
*Agrobacterium*, compensation for mutated auxin biosynthesis gene, *Nicotiana glutinosa*, 1337
Air, high carbon dioxide or, alternative oxidase, *Chlamydomonas reinhardtii*, 958
Air pollutants, alteration of extracellular enzymes, pinto bean leaves, 159
Alcohol dehydrogenase, dependence of ethanolic fermentation, hypoxic maize root tips, 1275
Alfalfa
cold-acclimation-specific genes, molecular cloning, freezing tolerance, 375
detection of norspermidine and norspermine, 525
Algae
*Chara australis*, characterization, aminopeptidase II, 687
*Chlamydomonas reinhardtii*
active carbon dioxide transport, 1213
chloroplasts, polypeptide precursor import, 15
membrane-associated polypeptides, carbon dioxide concentrations, 133
photosynthetic membrane protein, 100
*Chlorella sorokiniana*, nitrate reductase, synthesis and degradation, 220
*Chlorella vulgaris*, biosynthesis, tetrapyrrole pigment precursors, 852
*Chondrus crispus*, photosynthetic carbon dioxide uptake, 93
*Dunaliella salina*, osmoregulatory mechanism, plasma membrane ATPase, 1258
*Scenedesmus obliquus*, mode of action, nitrodiphenyl ether herbicides, 674
*Selenastrum minutum*, mitochondrial respiration, nitrogen assimilation, 409
*Ulva lactuca*, $^{31}P$ and $^{14}N$ NMR, 1380
Alkanes, deposition of aliphatic suberin monomers and, aging, potato tuber tissue, 1021
*Alternaria alternata*, host-specific effects of toxin, mitochondria, citrus, 925
*Amaranthus edulis*, purification of NAD malic enzyme, 316
*Amaranthus tricolor*
sodium nutrition, chloroplast ultrastructure, 539
sodium-stimulated growth, enhanced nitrate assimilation, 1102
Amino acid
metabolism in *Lemna minor*, 1161
peptide uptake and, scutella, germinating grains, 1285
phenylalanine uptake, tonoplast adenosine triphosphatase, barley vacuole, 1388
rosmarinic acid-producing cell cultures, *Anchusa officinalis*, 429
1-Aminocyclopropane-1-carboxylic acid, inhibition of conversion to ethylene, carnation microsomes, 1053
δ-Aminolevulinate, biosynthesis of tetrapyrrole pigment precursors, *Chlorella vulgaris*, 852
Aminopeptidase II, partial purification and characterization, *Chara australis*, 687
Aminopropyltransferase, detection of norspermidine and norspermine, alfalfa, 525
Ammonia, photorespiratory, glutamate synthase mutants, *Arabidopsis thaliana*, 498
Ammonium
assimilation, carbon isotope fractionation, *Selenastrum minutum*, 1150
methionine sulfoximine and asparaginase activity, pea leaves, 192
regulation of pyruvate dehydrogenase complex, pea, 1207
*Amorphophallus rivieri*, mitochondria, monoclonal antibodies, alternative oxidase, 1311
β-Amylase
photoregulation, mustard cotyledons, 860
release and activity, germinating barley grain, 244
Amyloplast, inner envelope membranes of sycamore, ATP/ADP-translocator, 1024
*Anabaena*, hydrogenase activity, physiological factors, 1035
*Ananas comosus* (*see* Pineapple)
*Anchusa officinalis*, behavior of free aromatic amino acid pools, rosmarinic acid-producing cell cultures, 429
Ancymidol, -induced changes in phototropic reaction, mung bean seedling, 1085
Antheridiogen, *Ceratopteris richardii*, evidence, gibberellin biosynthetic origin, 535
Anthesis, changes in cotton fruiting, conjugated indole-3-acetic acid, 941
*Apium gravelonse* (*see* Celery)
Apple, root formation, indole-3-acetic acid, indole-3-butyric acid, 439
*Arabidopsis*, freezing tolerance in cereals, hexadecenoic acid, 144
*Arabidopsis thaliana*
auxin-regulated gene, DNA-binding protein, 743
fusicoccin-binding proteins, 692
glutamate synthase mutants, photorespiratory ammonia, photosynthesis, 498
Arginine decarboxylase, inhibitor effects, tobacco leaf explants, 104
Artichoke, Jerusalem
diamine oxidase activity, different physiological stages, 69
enzyme localization, isolated vacuoles, fructan metabolism, 658
*Arum italicum*, mitochondria, monoclonal antibodies, alternative oxidase, 1311
Asparaginase, methionine sulfoximine and, pea leaves, 192
Asparagine, amino acid metabolism, *Lemna minor*, 1161
Aspartate aminotransferases, specificity for 4-substituted glutamic acids, leguminous plants, 1122
Assays
chlorotetracycline fluorescence, chloroplast envelope-bound magnesium, spinach, 753
electrophoretic, rubisco localization, broad bean, 1088
HPLC analysis, polyamines and agmatine, plant tissues, 512
spectrophotometric, interference by phosphatases, phosphoenolpyruvate carboxylase, 982
vanadate-sensitive ATPase, phospholipid requirement, corn roots, 867
ATP/ADP translocator, association with inner-envelope membranes, amyloplasts from sycamore, 1024
*Atriplex gmelini*, sodium uptake by mem-

brane vesicles, 180
Auxin
antagonism, xyloglucan oligosaccharides, rose, 883
asymmetry, gravitropism, tomato hypocotyls, 652
mutated biosynthesis gene, compensation, *Nicotiana glutinosa*, 1337
-regulated gene, DNA-binding protein, *Arabidopsis thaliana*, 743
*Avena sativa* (*see* Oat)
Avocado
mesocarp, cytochrome P-450, 1141
mitochondria, monoclonal antibodies, alternative oxidase, 1311

B

Barley
chloroplast development, plastid transcription, DNA copy number, 1011
cyanide metabolism, role for ethylene, 1306
germinating grain, release, bound β-amylase, 244
leaf, potassium chloride, abscisic acid-induced proline, 1226
root tonoplast
ATPases, plasma membrane effect, 1401
rapid induction, $Na^+/H^+$ exchange activity, 1
scutella, amino acid and peptide uptake, 1285
use of monoclonal antibodies, purification, sucrose-phosphate synthase, 518
vacuoles, phenylalanine uptake, tonoplast adenosine triphosphatase, 1388
Bean
activity ratios, ribulose-1,5-bisphosphate carboxylase, 735
diamine oxidase and air pollutants, 159
diurnal regulation, ribulose-1,5-bisphosphate carboxylase activity, 918
dynamics of imbibition, relation, initial seed moisture, 805
kinetics of 2-carboxyarabinitol 1-phosphate metabolism, 174
leaf
carbon metabolism, sinusoidal light I, 396
mild water stress, photosynthesis, 1060
reduced starch synthesis, sucrose phosphate synthase, 1066
seed development, 333
Beet
cell wall proteins, suspension culture, 712
diurnal regulation, ribulose-1,5-bisphosphate carboxylase activity, 918
kinetics of 2-carboxyarabinitol 1-phosphate metabolism, 174
leaf, proton-coupled sucrose transport, plasmalemma vesicles, 1318
leaf carbon metabolism
metabolite levels, sinusoidal light, 403
sinusoidal light I, 396
light/dark profiles, sucrose phosphate synthase, acid invertase, 347
use of monoclonal antibodies, purification, sucrose-phosphate synthase, 518
Benzophenanthridine alkaloids, *meta*-fluorotyrosine-tolerant cell culture, characterization, *Eschscholtzia californica*, 1299
*Beta vulgaris* (*see* Beet)
*Bradyrhizobium japonicum*
cytokinin production, 1247
symbiosis with soybean, $^{31}P$ NMR spectroscopic studies, 1238
*Brassica napus* (*see* Rapeseed)
*Brassica rapa*, gibberellin-deficient mutant, 482
Broad bean
antibody preparation, indoleacetic acid-C5-BSA, 1071
individual stomates, aperture, repeated measurements, 387
rubisco localization, electrophoretic assay, 1088
Bud, primordia, supercooling, peach flower, 1031
Bundle sheath cells
light-harvesting chlorophyll *a*/*b*-protein, maize, 602
localization of ferredoxin isoproteins, maize leaf, 1193
normal and salt-treated millet leaves, fluorescence, delayed light emission, 211

C

Cabbage, UDP-glucose:(1,3)-β-glucan synthase inactivation, 1341
Cadmium, poly(γ-glutamylcysteinyl)glycine synthesis, *Datura innoxia*, 700
Calcium
cold liability, pyruvate,pi dikinase, maize, 280
photoperiodic flower induction process, *Pharbitis nil*, 530
red light and abscisic acid, gravitropism, 875
Callus, tobacco leaf explants, inhibitor effects, arginine and ornithine decarboxylase, 104
Calmodulin, purification and characterization, *Papaver somniferum*, *Euphorbia lathyris*, 501
CAM plants, pineapple, carbon dioxide and oxygen exchanges, 61
Canopy, sparse, photomodulation of axis extension, *Datura ferox*, 1324
Carbamylation, activity ratios of ribulose-1,5-bisphosphate carboxylase, bean and spinach, 735
Carbohydrate
limitation of, effects, tobacco, 457
partitioning, net carbon dioxide assimilation, grapevine leaves, 1136
Carbon
assimilation, photosynthetic plasticity, *Flaveria brownii*, 1129
fixation, genetic variability, maize plants, 416
growth and composition, maize kernels, 341
inorganic, uptake of, *Dunaliella tertiolecta* chloroplasts, 1264
leaf metabolism
metabolite levels, sinusoidal light, 403
sinusoidal light I, beet and bean, 396
partitioning, phosphorus nutrition, soybean, 225
-reduction-cycle intermediates and photosynthesis, mild water stress, bean leaves, 1060
sugar content and activity, sucrose metabolism enzymes, milled rice grain, 893
Carbon dioxide
acclimation of photosynthesis, $C_3$ species, 590
active transport, *Chlamydomonas reinhardtii*, 1213
air or, alternative oxidase, *Chlamydomonas reinhardtii*, 958
ethoxyzolamide inhibition of uptake, *Synechococcus* PCC7942, 37
limited concentrations, membrane-associated polypeptides, *Chlamydomonas reinhardtii*, 133
low, lack of adaptation, *Chlamydomonas reinhardtii*, 897
mechanism of photosynthetic uptake, *Chondrus crispus*, 93
net assimilation, carbohydrate partitioning, grapevine leaves, 1136
oxygen and, exchanges, pineapple, 61
photosynthetically distinct *Flaveria* species, leaf anatomy, hybrids, 839
regulation of catalase activity, tobacco, 952
Carbonic anhydrase
activity associated with *Synechococcus* PCC7942, 51
inhibition of carbon dioxide uptake, ethoxyzolamide, *Synechococcus* PCC7942, 37
intracellular, *Chlamydomonas reinhardtii*, 904
2-Carboxyarabinitol 1-phosphate, kinetics of metabolism, bean, beet and spinach, 174
Carnation
microsomes, inhibitor, 1-aminocyclopropane-1-carboxylic acid conversion, 1053
reversible inhibition of ethylene action, petal senescence interruption, norbornadiene, 434
Carrot
characterization of inositol phosphates, 126
HPLC analysis, polyamines and agmatine, 512
phosphatidylinositol(4,5)bisphosphate, phosphatidylinositol(4)phosphate and, 888
role of glycans, cell wall β-fructosidase, 845
Cassava plants, identification, actively filling sucrose sinks, 1117
Castor bean
lipase inhibition, coenzyme A and oleoyl-CoA, 1006
protein synthesis in mitochondria, stimulation, cyanide, 669
Catalase
regulation of activity, high carbon dioxide, tobacco, 952
synthesis and turnover, peroxisome transition, sunflower cotyledons, 1000
*Catharanthus roseus*
changes in polypeptides and mRNAs, cell cycle, 910
regulation of vacuolar pH, 19, 27
Celery, senescing organs, α-tocopherol accumulation, chlorophyll degradation, 1028
Cell cycle
changes in polypeptides and mRNAs, *Catharanthus roseus*, 910
*Chlorella sorokiniana*, synthesis and degradation, nitrate reductase, 220
Cellulysin, induction of ethylene biosynthesis, xylanase, tobacco, 138
Cell wall
bud-specific gene expression in pea, similarity, seed lectins, 833
β-fructosidase, role of glycans, carrot, 845
metabolism, ripening pear fruit, 1394

proteins, suspension culture, sugar beet cells, 712
proton and copper adsorption, corn and soybean root, 823
structure of pectic polysaccharide fraction, corn, 792
tomato fruit, synthesis, development and senescence, 477
*Ceratopteris richardii*, antheridiogen, evidence, gibberellin biosynthetic origin, 535
Cereals, freezing tolerance, hexadecenoic acid, 144
*Chara australis*, partial purification and characterization, aminopeptidase II, 687
*Chara corallina*, cytoplasmic and vacuolar buffer capacities, 1049
Chilling
impairment of tonoplast $H^+$-ATPase, mung bean, 634
liability, pyruvate,pi dikinase, maize, 280
susceptibility, chlorophyll fluorescence transients, soybean, 740
China tree, senescing organs, $\alpha$-tocopherol accumulation, chlorophyll degradation, 1028
Chitinases, identification of pathogenesis-related proteins, tomato leaves, 945
*Chlamydomonas eugametos*, polyphosphoinositides, 888
*Chlamydomonas reinhardtii*
active carbon dioxide transport, 1213
intracellular carbonic anhydrase, 904
mutant, lack of adaptation, low carbon dioxide, 897
preparation of chloroplasts, import, polypeptide precursors, 15
variations in alternative oxidase, air or high carbon dioxide, 958
*Chlorella sorokiniana*
nitrate reductase deficient mutants, characterization, 786
nitrate reductase synthesis and degradation, cell cycle, 220
*Chlorella vulgaris*
biosynthesis, tetrapyrrole pigment precursors, 852
raffinose synthesis after cold shock, 648
Chlorophyll
degradation, $\alpha$-tocopherol accumulation, various plants, 1028
fluorescence transients, cold-induced low-waves, soybean, 740
Chloroplast
development in barley, plastid transcription, DNA copy number, 1011
*Chlamydomonas reinhardtii*, import, polypeptide precursors, 15
*Dunaliella tertiolecta*, inorganic carbon uptake, 1264
envelope-bound magnesium in spinach, assay development, chlorotetracycline fluorescence, 753
maize, major light-harvesting chlorophyll *a/b*-protein, 602
protein import, pea, 993
spinach
division cycle and DNA synthesis, spinach leaf discs, 1178
entry of fructose-2,6-bisphosphate, 1270
inhibited respiration, osmotic dehydration, 1158
light-dependent increase, phosphoglucomutase activity, 557
tobacco mosaic virus, viral coat protein, reduced photosystem II activity, 111
ultrastructure, sodium nutrition, $C_4$ plants, 539
wheat, thylakoid protein phosphatase, 238
Chlorotetracycline, fluorescence assay, chloroplast envelope-bound magnesium, spinach, 753
*Chondrus crispus*, mechanism, photosynthetic carbon dioxide uptake, 93
Chorismate mutase
dual-pathway hypothesis, aromatic biosynthesis, potato, 10
isozymes, differential activities, potato tubers and leaves, 472
Chromatography, HPLC, nucleotide compartmentation, corn root tips, 963
Chrysanthemum, inhibition of rooting, role of ethylene, low oxygen tensions, 165
Circadian rhythm
differential photosynthetic gene expression, diurnal cycle, petunia, 776
diurnal regulation of rubisco activity, bean, beet and spinach, 918
Citrate synthase, mitochondrial, purification, pea, 719
Citrus, freezing tolerance, 444
*Citrus jambhiri* (*see* Lemon, rough)
*Citrus paradisi* (*see* Grapefruit)
*Citrus reticulata* (*see* Mandarin)
*Citrus sinensis* (*see* Orange)
*Cladosporium fulvum*, indentification of pathogenesis-related proteins, tomato leaves, 945
Cold
acclimation, freezing tolerance proteins, wheat, 577
-acclimation-specific genes, freezing tolerance, alfalfa, 375
-induced low-waves in soybean, chlorophyll fluorescence transients, 740
shock, raffinose synthesis, *Chlorella vulgaris*, 648
Copper, adsorption, corn and soybean root cell walls, 823
Corn
*Alternaria alternata* toxin, host-specific effects, citrus, 925
cold liability, pyruvate,pi dikinase, 280
cytokinin antagonist activity, substituted phenethylamines, 564
developing kernels, separation, hexose kinases, 1042
embryo
abscisic acid biosynthesis, 1039
glassy state, 977
genetic variability, sucrose-P-synthase, ADP glucose pyrophosphorylase, 416
kernel, growth and composition, carbon and nitrogen, 341
leaf, ferredoxin isoproteins, mesophyll and bundle sheath cells, 1193
mesophyll and bundle sheath cells, light-harvesting chlorophyll *a/b*-protein, 602
protoplasts of suspension cells, characterization, potassium-dependent currents, 1184
red light and gravitropism, abscisic acid, calcium, 875
root
cell walls, proton and copper adsorption, 823
development, water conducting capacity, 1094
endogenous abscisic acid, light effects, 622
multiphasic uptake of potassium, 231
protein kinase activities, 151
vanadate-sensitive ATPase, measurement methods, 867
root-generated ionic currents, primary root growth, 1198
root microsomes, vanadate-sensitive proton transport, kinetic analysis, 464
root tip
ethanolic fermentation, alcohol dehydrogenase, 1275
localization, $H^+$-ATPase, 391
malate, NMR study, 197
nucleotides, $^{31}P$-NMR and HPLC, 963
scutella, amino acid and peptide uptake, 1285
shoot, structure, pectic polysaccharide fraction, 792
use of monoclonal antibodies, purification, sucrose-phosphate synthase, 518
Cotton
changes in conjugated indole-3-acetic acid, 941
cytokinin antagonist activity, substituted phenethylamines, 564
root cells, nutrient stress, hydraulic conductivity, 264
seed, malate synthase aggregation behavior, 352
Cotyledon
cucumber, peroxidase regulation, localization, 664
mustard, $\beta$-amylase, photoregulation, 860
sunflower, catalase synthesis, peroxisome transition, 1000
*Vigna mungo* seeds, activation, sulfhydryl-endopeptidase, 274
$C_3$ plants, acclimation of photosynthesis, carbon dioxide, 590
$C_4$ plants
*Flaveria brownii*, photosynthetic plasticity, 1129
localization of ferredoxin isoproteins, mesophyll and bundle sheath cells, maize leaf, 1193
NAD malic enzyme, purification and characterization, 316
rapeseed and pea, photosynthesis effects, 3,3-dichloro-2-(dihydroxymethyl)propenoate, 1231
sodium nutrition, chloroplast ultrastructure, 539
Cucumber
cotyledons, peroxidase regulation, localization, 664
dynamics of transpiration stream in stem, 643
*Cucumis sativus* (*see* Cucumber)
Cyanide, metabolism, role for ethylene, higher plants, 1306
Cyanobacteria
hydrogenase activity, physiological factors, 1035
light-induced proton efflux, sodium uptake, 1220
salt tolerance, enhancement of, combined nitrogen, 204
*Synechococcus* PCC7942
carbonic anhydrase activity, 51
ethoxyzolamide, photosynthesis inhibition, 44
ethoxyzolamide inhibition, carbon dioxide uptake, 37

*Cycas revoluta*, phycoerythrin occurrence and localization, 783
Cytochrome P-450, mesocarp of avocado, 1141
Cytokinin
antagonist activity, substituted phenethylamines, plant cell culture, 564
naphthaleneacetic acid-tolerant tobacco mutant, hormonal characterization, 86
production by *Bradyrhizobium japonicum*, 1247
Cytokinin *O*-glucosides, quantification of, negative ion mass spectrometry, soybean, 74
Cytoplasm, vacuolar buffer capacities, *Chara corallina*, 1049
Cytosol, inhibitor of 1-aminocyclopropane-1-carboxylic acid conversion, carnation microsomes, 1053

D

Dark, profile, sucrose phosphate synthase, beet, 347
*Datura ferox*, photomodulation of axis extension, sparse canopies, 1324
*Datura innoxia*, poly(γ-glutamylcysteinyl)glycine synthesis, binding with cadmium, 700
*Daucus carota* (*see* Carrot)
3-Deoxy-D-arabino-heptulosonate 7-phosphate synthase, dual-pathway hypothesis, aromatic biosynthesis, potato, 10
1-Deoxymannojirimycin, inhibition of Golgi-mediated processing, bean storage glycoproteins, 1079
Deoxyribonucleic acid
-binding protein, auxin-regulated gene, *Arabidopsis thaliana*, 743
copy number, plastid transcription, barley chloroplast development, 1011
$H_2$ metabolism in *Bradyrizobium*, nodule expression, lupines, 78
synthesis in spinach leaf discs, light effect, chloroplast division cycle, 1178
Diacylglycerol, light-stimulated inositol phospholipid turnover, *Samanea saman* pulvini, 724
Diamine oxidase
activity in different physiological stages, Jerusalem artichoke, 69
exposure to air pollutants, pinto bean leaves, 159
*Dianthus caryophyllus* (*see* Carnation)
3,3-Dichloro-2-(dihydroxyphosphinoylmethyl)propenoate, effects on photosynthesis, rapeseed and pea, 1231
2-(3,4-Dichlorophenoxy)triethylamine, enzymic synthesis of polyisoprene, guayule plants, 506
Dihydroxyacetone phosphate reductase, changes during spinach leaf maturation, 305
*Dunaliella salina*
osmoregulatory mechanism, plasma membrane ATPase, 1258
plasma membrane characterization, sodium chloride acclimation, 970
*Dunaliella tertiolecta*, chloroplasts, inorganic carbon uptake, 1264

E

Electrofusion, effects of microgravitation, plant cell protoplasts, 1172
*Eleusine coracana*, purification of NAD malic enzyme, 316
Endoplasmic reticulum, malate synthase aggregation behavior, cottonseed, 352
Endoxylanase, induction of ethylene biosynthesis, xylanase, tobacco, 138
Epicotyl, pea, elongation regulation, blue light, 293, 544
Epidermal cells, fescue, nitrogen effects, blade growth, 549
*Eschscholtzia californica*, characterization, *meta*-fluorotyrosine-tolerant cell culture, 1299
Ethanol, fermentation, alcohol dehydrogenase activity, hypoxic maize root tips, 1275
Ethoxyzolamide
inhibition of carbon dioxide uptake, *Synechococcus* PCC7942, 37
inhibition of photosynthesis, *Synechococcus* PCC7942, 44
Ethylene
biosynthesis, induction by xylanase, tobacco, 138
inhibited 1-aminocyclopropane-1-carboxylic acid conversion, carnation microsomes, 1053
reversible inhibition, norbornadiene, carnation flower petals, 434
role in cyanide metabolism, higher plants, 1306
role in inhibition of rooting, low oxygen tensions, chrysanthemums, 165
*Euphorbia lathyris*
purification and characterization, calmodulins, 501
terpenoid biosynthesis, 681
Exopolysaccharides, production in hosts' infected leaves, phytopathogenic *Pseudomonas syringae*, 5

F

Fatty acids
exogenous, acylation of acyl carrier protein, *Spirodela oligorrhiza*, 707
lipase inhibition, coenzyme A and oleoyl-CoA, castor bean, 1006
Ferredoxin, isoproteins in mesophyll and bundle sheath cells, maize leaf, 1193
Ferredoxin-NADP$^+$ reductase, expression during salt stress, *Mesembryanthemum crystallinum*, 817
Fescue, blade growth, nitrogen effects, 549
*Festuca arundinacea* (*see* Fescue)
*Flaveria*, photosynthetically distinct species, leaf anatomy, hybrids, 839
*Flaveria brownii*, photosynthetic plasticity, 1129
Flower
endogenous gibberellins, shoot growth, rapeseed, 269
induction process, calcium involvement, *Pharbitis nil*, 530
peach bud primordia, supercooling, 1031
Fluorescence
delayed light emission and, normal and salt-treated millet leaves, 211
transients, cold-induced low-waves and chlorophyll, soybean, 740
*meta*-Fluorotyrosine, -tolerant cell culture, characterization, *Eschscholtzia californica*, 1299
Freezing
supercooling characteristics, peach flower bud primordia, 1031
-thaw injury, protocol effect, potato, 1372
tolerance
citrus and spinach, petunia leaf tissue, 444
cold-acclimation-specific genes, alfalfa, 375
hexadecenoic acid, cereals, 144
protein synthesis, wheat, 577
Fructan, metabolism, enzyme localization in vacuoles, Jerusalem artichoke, 658
Fructose-1,6-bisphosphatase, photosynthetic, pea leaf tissue, 381
Fructose 1,6-bisphosphate
inhibition of chloroplastic respiration, osmotic dehydration, spinach, 1158
substrate-product interactions, pyrophosphate, potato tuber, 628
Fructose-2,6-bisphosphate, entry into spinach chloroplasts, 1270
β-Fructosidase, inhibition of secretion by tunicamycin, unglycosylated protein breakdown, carrot, 845
Fusicoccin
binding protein
*Arabidopsis thaliana*, 692
purification, oat root plasma membrane, 250
root-generated ionic currents, primary root growth, corn, 1198

G

Gabaculine, biosynthesis of tetrapyrrole pigment precursors, *Chlorella vulgaris*, 852
Gene
auxin-regulated, DNA-binding protein, *Arabidopsis thaliana*, 743
bud-specific expression in pea, similarity, seed lectins, 833
Germination
dynamics of imbibition, bean seed, 805
seed dormancy in red rice, 879
Gibberellic acid, trunk girdling, photosynthesis, grapevine, 1136
Gibberellin
biosynthetic origin of antheridiogen, *Ceratopteris richardii*, 535
-deficient *Brassica* mutant, 482
endogenous, shoot growth, rapeseed, 269
mechanism of action in peas, 184
Girdling, trunk, gibberellic acid application, grapevine, 1136
1,3-β-Glucanases, identification of pathogenesis-related proteins, tomato leaves, 945
Glucosinolate, uptake, developing rapeseed embryos, 260
Glutamate, biosynthesis of tetrapyrrole pigment precursors, *Chlorella vulgaris*, 852
Glutamate synthase, *Arabidopsis thaliana* mutants, photorespiratory ammonia, photosynthesis, 498
Glutamic acids, 4-substituted, aspartate aminotransferases, leguminous plants, 1122
Glutamine, amino acid metabolism, *Lemna minor*, 1161
Glycans, cell wall β-fructosidase, unglycosylated protein breakdown, carrot, 845
*Glycine max* (*see* Soybean)
Glycoproteins
endomembrane, soybean root, 299
inhibition of Golgi-mediated processing, 1-deoxymannojirimycin, bean, 1079

style, pollen-tube growth, tobacco, 360
Glyoxysomes, malate synthase aggregation behavior, cottonseed, 352
Golgi complex, inhibition of processing, 1-deoxymannojirimycin, bean storage glycoproteins, 1079
*Gossypium hirsutum* (*see* Cotton)
Grapefruit, *Alternaria alternata* toxin, host-specific effects, mitochondria, 925
Grapevine, leaf, net carbon dioxide assimilation, carbohydrate partitioning, 1136
Gravitropism
  auxin asymmetry, tomato hypocotyls, 652
  red light and abscisic acid, calcium, corn, 875
Guard cells, broad bean, rubisco localization, electrophoretic assay, 1088
Guayule, enzymic synthesis of polyisoprene, 506

H

*Hapalosiphon*, hydrogenase activity, physiological factors, 1035
$H^+$-ATPase
  biosynthesis, oat tonoplast, 1292
  immunocytochemical localization, maize root tip cells, 391
  impairment of, chilling, mung bean, 634
  regulation of vacuolar pH, plant cells, 27
Heat shock proteins, thermotolerance of isolated mitochondria, soybean, 617
*Helianthus annuus* (*see* Sunflower)
*Helianthus tuberosus* (*see* Artichoke, Jerusalem)
*Helminthosporium maydis*, *Alternaria alternata* toxin, host-specific effects, citrus, 925
Herbicides
  nitrodiphenyl ether, mode of action, algae, 674
  resistance, $Q_B$ protein, tobacco cells, 986
Hexadecenoic acid, freezing tolerance in cereals, 144
Hexose kinases, separation and characterization, developing maize kernels, 1042
*Hippuris vulgaris*, leaf morphology, abscisic acid content, photon fluence rate, 732
*Hordeum vulgare* (*see* Barley)
Hydrogenase, activity in cyanobacteria, physiological factors, 1035
Hydroxycinnamoyl-CoA:putrescine hydroxycinnamoyltransferase, high and low levels of caffeoylputrescine, tobacco cell cultures, 488
Hydroxycinnamoyl putrescine, arginine and ornithine decarboxylase inhibitor effects, tobacco leaf explants, 104
Hypocotyl, tomato, auxin asymmetry, gravitropism, 652
Hypoxia, maize root tips, ethanolic fermentation, alcohol dehydrogenase activity, 1275

I

Imbibition
  dynamics of, bean seed, 805
  glassy state in corn embryos, 977
Indoleacetic acid
  naphthaleneacetic acid-tolerant tobacco mutant, hormonal characterization, 86
  root-generated ionic currents, primary root growth, corn, 1198
Indole-3-acetic acid
  adventitious root formation, indole-3-butyric acid, apple, 439
  conjugated, changes in fruiting, cotton, 941
Indoleacetic acid-C5-BSA, novel antigen, antibody preparation, 1071
D-*myo*-Inositol, polyphosphoinositides in plant tissues, 888
Inositol phosphates, characterization in carrot cells, 126
Ionic currents, root-generated, primary root growth, corn, 1198
Irradiance, diurnal regulation of rubisco activity, bean, beet and spinach, 918
Isopentenyladenine, naphthaleneacetic acid-tolerant tobacco mutant, hormonal characterization, 86

K

*Kochia childsii*, sodium nutrition, chloroplast ultrastructure, 539

L

*Lactuca sativa*, cyanide metabolism, role for ethylene, 1306
Leaf
  barley, potassium chloride, abscisic acid-induced proline, 1226
  bean
    carbon metabolism, sinusoidal light I, 396
    mild water stress, photosynthesis, 1060
  beet
    carbon metabolism, sinusoidal light, 396, 403
    proton-coupled sucrose transport, plasmalemma vesicles, 1318
  citrus, freezing tolerance, 444
  corn, ferredoxin isoproteins, mesophyll and bundle sheath cells, 1193
  *Flaveria*, photosynthetically distinct species, hybrids, 839
  grapevine, net carbon dioxide assimilation, carbohydrate partitioning, 1136
  infected, exopolysaccharide production, *Pseudomonas syringae*, 5
  millet, fluorescence, delayed light emission, 211
  morphology of *Hippuris vulgaris*, abscisic acid content, photon fluence rate, 732
  pea
    light energy dissipation, photoinhibition, 286
    methionine sulfoximine, asparaginase activity, 192
    NADH-induced superoxide radicals, peroxisomes, 728
    photosynthetic fructose-1,6-bisphosphatase, 381
  petunia, freezing tolerance, 444
  pinto bean, exposure to air pollutants, 159
  potato, differential activities, chorismate mutase isozymes, 472
  soybean
    phosphate compartmentation, $^{31}P$ NMR study, 1331
    vegetative storage protein gene expression, 309
  spinach
    changes, dihydroxyacetone phosphate reductase, 305
    freezing tolerance, 444
    light effect, chloroplast division cycle, 1178
  tobacco
    arginine decarboxylase, ornithine decarboxylase, 104
    regulation, catalase activity, 952
  tomato, identification, pathogenesis-related proteins, 945
  wheat, synthesis, freezing tolerance proteins, 577
Lectins, seed, bud-specific gene expression, pea, 833
Leguminous plants, specificity of aspartate aminotransferases, 4-substituted glutamic acids, 1122
*Lemna minor*, amino acid metabolism, 1161
Lemon, rough, *Alternaria alternata* toxin, host-specific effects, mitochondria, 925
Light
  blue
    regulation of elongation, pea epicotyl, 293, 544
    transplasmalemma electron transport, oat mesophyll cells, 1345
  delayed emission and fluorescence, normal and salt-treated millet leaves, 211
  -dependent increase, phosphoglucomutase activity, spinach chloroplasts, 557
  effect on chloroplast division cycle, DNA synthesis, spinach leaf discs, 1178
  effects, endogenous abscisic acid, growing maize roots, 622
  energy dissipation, photoinhibition, pea leaves, 286
  -induced proton efflux, sodium uptake, cyanobacteria, 1220
  photomodulation of axis extension, sparse canopies, *Datura ferox*, 1324
  photon fluence rate, abscisic acid and leaf morphology, *Hippuris vulgaris*, 732
  photosynthetic apparatus, pea thylakoid membranes, 932
  phototropic reaction, growth retardant, mung bean seedling, 1085
  profile, sucrose phosphate synthase, beet, 347
  red, abscisic acid and calcium, gravitropism, 875
  saturating pulses, chlorophyll fluorescence transients, soybean, 740
  -stimulated phospholipid turnover, *Samanea saman* pulvini, 724
Light-harvesting chlorophyll *a/b* protein
  differential gene expression, diurnal cycle, petunia, 776
  mesophyll and bundle sheath chloroplasts, maize, 602
Lima bean
  identification, actively filling sucrose sinks, 1117
  seed, sucrose metabolism, 1106
Lipase, inhibition by coenzyme A and oleoyl-CoA, castor bean lipid bodies, 1006
Lipids, plasma membrane characterization, sodium chloride acclimation, *Dunaliella salina*, 970
Locus, *rb*, ADP glucose pyrophosphorylase, pea embryos, 1279
Lupines, $H_2$ metabolism, *Bradyrhizobium*, nodule expression, 78
*Lupinus* (*see* Lupines)
*Lycopersicon esculentum* (*see* Tomato)

M

Magnesium
chloroplast envelope-bound, chlorotetracycline fluorescence assay, spinach, 753
cold liability, pyruvate,pi dikinase, maize, 280
Maize (*see* Corn)
Malate
carbon dioxide and oxygen exchanges, pineapple, 61
cytoplasmic and vacuolar, NMR study, maize root tips, 197
Malate synthase, aggregation behavior, glyoxysomes, cottonseed, 352
*Malus pumila* (*see* Apple)
Mandarin, *Alternaria alternata* toxin, host-specific effects, mitochondria, 925
Manganese, cold liability, pyruvate,pi dikinase, maize, 280
Mass spectrometry, negative ion, cytokinin *O*-glucosides, soybean, 71
*Medicago falcata* (*see* Alfalfa)
*Medicago sativa* (*see* Alfalfa)
*Melia azedarach*, senescing organs, α-tocopherol accumulation, chlorophyll degradation, 1028
Membrane vesicles, sodium uptake, *Atriplex gmelini*, 180
*Mentha spicata* (*see* Spearmint)
*Mesembryanthemum crystallinum*
salt stress
ferredoxin-NADP$^+$ reductase expression, 817
time course of mRNA induction, 811
Mesocarp, avocado, cytochrome P-450, 1141
Mesophyll cells
fescue, nitrogen effects, blade growth, 549
light-harvesting chlorophyll *a*/*b*-protein, maize, 602
localization of ferredoxin isoproteins, maize leaf, 1193
normal and salt-treated millet leaves, fluorescence, delayed light emission, 211
oat, transplamalemma electron transport, sphingoid bases, 1345
tobacco protoplasts, photorespiratory properties, 762
Methionine sulfoximine, asparaginase activity and, pea leaves, 192
Mevalonate, terpenoid biosynthesis, *Euphorbia lathyris*, 681
Microgravitation, effects on electrofusion, plant cell protoplasts, 1172
Microsome
carnation, inhibitor, 1-aminocyclopropane-1-carboxylic acid conversion, 1053
maize root, kinetic analysis, vanadate-sensitive proton transport, 464
Millet, normal and salt-treated leaves, fluorescence, delayed light emission, 211
Mitochondria
castor bean, cyanide stimulation, protein stimulation, 669
citrate synthase, purification, pea, 719
higher plants, monoclonal antibodies, alternative oxidase, 1311
host-specific effects, *Alternaria alternata* toxin, citrus, 925
regulation of pyruvate dehydrogenase complex, pea, 1207
respiration, photosynthetic nitrogen assimilation, *Selenastrum minutum*, 409
thermotolerance, heat shock proteins, soybean, 617
Monoclonal antibodies
alternative oxidase, higher plant mitochondria, 1311
sucrose-phosphate synthase, purification, various plants, 518
Monoterpene, biosynthesis in glandular trichomes, spearmint, 1351
Mung bean
impairment of tonoplast H$^+$-ATPase, chilling, 634
mitochondria, monoclonal antibodies, alternative oxidase, 1311
phototropic reaction of seedlings, growth retardant-induced changes, 1085
Mustard
cotyledons, β-amylase, photoregulation, 860
cyanide metabolism, role for ethylene, 1306
Myosin, actin and, pea tendrils, 586

N

NADH, -induced generation of superoxide radicals, pea leaf peroxisomes, 728
NAD malic enzyme, purification and characterization, $C_4$ plants, 316
Na$^+$/H$^+$ antiport
rapid induction in activity, barley root tonoplast, 1
sodium uptake by membrane vesicles, *Atriplex gmelini*, 180
Napthaleneacetic acid, -tolerant tobacco mutant, hormonal characterization, immunoenzymic method, 86
*Nicotiana* (*see* Tobacco)
Nitrate
enhanced assimilation, sodium-stimulated growth, *Amaranthus tricolor*, 1102
-tolerant nodulation mutants, selection, soybean, 169
Nitrate reductase
deficient mutants of *Chlorella sorokiniana*, characterization, 786
synthesis and degradation, cell cycle, *Chlorella sorokiniana*, 220
Nitrodiphenyl ether, herbicides, mode of action, algae, 674
Nitrogen
combined, enhancement, cyanobacterial salt tolerance, 204
-deficient cotton seedlings, hydraulic conductivity, 264
effects of carbohydrate limitation, tobacco, 457
effects on blade growth, fescue, 549
growth and composition, maize kernels, 341
main stem sink manipulation, wheat, 597
phosphorus-31 and nitrogen-14 NMR, uptake, *Ulva lactuca*, 1380
photosynthetic assimilation, mitochondrial respiration, *Selenastrum minutum*, 409
Nodulation, partially nitrate-tolerant mutants, selection, soybean, 169
Norbornadiene, interruption of petal senescence, carnation flowers, 434
Norspermidine, norspermine and, detection of, alfalfa, 525
*Nostac* 7422, phycoerythrin occurrence and localization, 783
Nuclear magnetic resonance spectroscopy
carbon-13, cytoplasmic and vacuolar malate, maize root tips, 197
nucleotides in corn root tips, 963
phosphate compartmentation, soybean leaves, 1331
phosphorus-31, regulation of vacuolar pH, plant cells, 19, 27
phosphorus-31 and nitrogen-14, uptake, marine macroalgae, 1380
soybean *Bradyrhizobium* symbiosis, 1238
Nucleotides, compartmentation, $^{31}$P-NMR and HPLC, corn root tips, 963

O

Oat
mesophyll cells, transplasmalemma electron transport, sphingoid bases, 1345
root plasma membrane, purification, fusicoccin binding protein, 250
tonoplast ATPase biosynthesis, 1292
Oleic acid, lipase inhibition, coenzyme A and oleoyl-CoA, castor bean, 1006
Oligosaccharides, xyloglucan, auxin antagonism, rose, 883
Oncogenes, compensation for *tms* mutations, auxin biosynthesis gene, *Nicotiana glutinosa*, 1337
Orange, senescing organs, α-tocopherol accumulation, chlorophyll degradation, 1028
Ornithine decarboxylase, inhibitor effects, tobacco leaf explants, 104
*Ornithopus compressus*, $H_2$ metabolism in *Bradyrizobium*, nodule expression, lupines, 78
*Oryza sativa* (*see* Rice)
Oxidase, alternative, monoclonal antibodies, higher plant mitochondria, 1311
Oxygen
carbon dioxide and, exchanges, pineapple, 61
low, ethylene role in rooting, chrysanthemum, 165
Ozone, alteration of extracellular enzymes, pinto bean leaves, 159

P

*Panicum dichotomiflorum*, purification of NAD malic enzyme, 316
*Panicum miliaceum* (*see* Millet)
*Papaver somniferum*, purification and characterization, calmodulins, 501
Parsley, sensecing organs, α-tocopherol accumulation, chlorophyll degradation, 1028
*Parthenium argentatum* (*see* Guayule)
Pathogenesis, -related proteins, identification, tomato leaves, 945
Pea
association of rubisco with phosphoribulokinase, 368
bud-specific gene expression, similarity, seed lectins, 833
chloroplast protein import, 993
cyanide metabolism, role for ethylene, 1306
3,3-dichloro-2-(dihydroxyphosphinoylmethyl)propenoate, effects on photosynthesis, 1231
epicotyl, elongation regulation, blue light, 293, 544
leaf
light energy dissipation, photoinhibition, 286
methionine sulfoximine, asparaginase activity, 192

photosynthetic fructose-1,6-bisphosphatase, 381
leaf peroxisomes, NADH, superoxide radical generation, 728
mechanism of gibberellin action, 184
phosphatidylinositol(4,5)bisphosphate, phosphatidylinositol(4)phosphate and, 888
purification and characterization, mitochondrial citrate synthase, 719
*rb* locus, starch synthesis enzymes, ADP glucose pyrophosphorylase, 1279
regulation, mitochondrial pyruvate dehydrogenase complex, 1207
rubisco assembly mechanism, delayed osmotic effect, 1366
seedling, phytochrome-mediated phototropism, 493
tendrils, actin and myosin, 586
thylakoid membranes, photosynthetic apparatus, 932
Peach, flower bud primordia, supercooling, 1031
Pear, ripening fruit, cell wall metabolism, 1394
Pectin, cell wall metabolism, ripening pear fruit, 1394
Peroxidase, regulation and localization, cucumber cotyledons, 664
Peroxisome
pea leaf, NADH-induced superoxide radicals, 728
transition in sunflower cotyledons, catalase synthesis and turnover, 1000
*Persea americana* (*see* Avocado)
*Petroselinum sativum* (*see* Parsley)
Petunia
freezing tolerance, 444
photosynthetic genes, differential expression, diurnal cycle, 776
pH
cytoplasmic and vacuolar buffer capacities, *Chara corallina*, 1049
ethanolic fermentation, alcohol dehydrogenase activity, hypoxic maize root tips, 1275
root-generated ionic currents, primary root growth, corn, 1198
vacuolar, regulation of, plant cells, 19, 27
*Pharbitis nil*, involvement of calcium, photoperiodic flower induction process, 530
*Phaseolus aureus*, cyanide metabolism, role for ethylene, 1306
*Phaseolus lunatus* (*see* Lima bean)
*Phaseolus vulgaris* (*see* Bean)
Phenethylamines, substituted, cytokinin antagonist activity, plant cell culture, 564
Phenylalanine
*meta*-fluorotyrosine-tolerant cell culture, characterization, *Eschscholtzia californica*, 1299
uptake into barley vacuoles, tonoplast adenosine triphosphatase, pyrophosphatase, 1388
Phosphate, compartmentation, $^{31}P$ NMR study, soybean leaves, 1331
Phosphatidylinositol(4,5)bisphosphate, phosphatidylinositol(4)phosphate and, pea and carrot, 888
Phosphoenolpyruvate carboxylase
interference by phosphatases, spectrophotometric assay, 982
significance during ammonium assimilation, *Selenastrum minutum*, 1150
Phosphofructokinase, inhibition of chloroplastic respiration, osmotic dehydration, spinach, 1158
Phosphoglucomutase, light-dependent increase of activity, spinach chloroplasts, 557
Phospholipases, UDP-glucose:(1,3)-$\beta$-glucan synthase inactivation, cabbage, 1341
Phospholipids, requirement in maize roots, vanadate-sensitive ATPase, measurement methods, 867
Phosphoribulokinase, association with rubisco, spinach and pea, 368
Phosphorus
-deficient cotton seedlings, hydraulic conductivity, 264
nutrition influence, carbon partitioning, soybean, 225
phosphorus-31 and nitrogen-14 NMR, uptake, *Ulva lactuca*, 1380
Photoinhibition, light energy dissipation, pea leaves, 286
Photoregulation, $\beta$-amylase, mustard cotyledons, 860
Photorespiration, properties of mesophyll protoplasts, tobacco, 762
Photosynthesis
acclimation, carbon dioxide elevation, $C_3$ species, 590
carbon dioxide uptake, mechanism of, *Chondrus crispus*, 93
3,3-dichloro-2-(dihydroxyphosphinoylmethyl)propenoate, effects, rapeseed and pea, 1231
electron transport, thermal acclimation, *Saxifraga cernua*, 325
ethoxyzolamide inhibition, *Synechococcus* PCC7942, 44
freeze-thaw injury, protocol effect, potato, 1372
function of membrane protein, *Chlamydomonas reinhardtii*, 100
genes of petunia, differential expression, diurnal cycle, 776
maintenance of, low leaf water potential, wheat, 1358
mild water stress, bean leaves, 1060
net carbon dioxide assimilation, carbohydrate partitioning, grapevine, 1136
pea thylakoid membranes, 932
photorespiratory ammonia, glutamate synthase mutants, *Arabidopsis thaliana*, 498
plasticity, *Flaveria brownii*, 1129
sinusoidal light, leaf carbon metabolism, beet, 403
square and sinusoidal light regimes, leaf carbon metabolism, beet and bean, 396
Photosystem II
reduced activity, viral coat protein, tobacco mosaic virus, 111
stabilization of reaction center complex, dark and light, polyethylene glycol, 452
Phototropism
ancymidol-induced changes, mung bean seedling, 1085
phytochrome-mediated, pea seedlings, 493
Phycoerythrin
hydrogenase activity in cyanobacteria, physiological factors, 1035
occurrence and localization, *Cycas revoluta*, *Nostac* 7422, 783
Phytochrome, -mediated phototropism, pea seedlings, 493
Pineapple, carbon dioxide and oxygen exchanges, 61
*Pisum sativum* (*see* Pea)
Plasmalemma
corn root, protein kinase activities, 151
regulation of electron transport, sphingoid bases, oat mesophyll cells, 1345
sugar beet leaves, proton-coupled sucrose transport, 1318
Plasma membrane
ATPase, osmoregulatory mechanism, *Dunaliella salina*, 1258
characterization, sodium chloride acclimation, *Dunaliella salina*, 970
oat root, purification, fusicoccin binding protein, 250
temperature effect, tonoplast ATPases, barley root, 1401
Plastid, transcription, DNA copy number, barley chloroplast development, 1011
Pollen, -tube growth, style glycoprotein, tobacco, 360
Polyamine
agmatine and, HPLC analysis, plant tissue, 512
arginine and ornithine decarboxylase inhibitor effects, tobacco leaf explants, 104
Polyethylene glycol, stabilization, photosystem II reaction center, spinach, 452
Polygalacturonase, temporal regulation of gene expression, tomato genotypes, 117
Poly($\gamma$-glutamylcysteinyl)glycine, synthesis, binding with cadmium, *Datura innoxia*, 700
Polyisoprene, enzymic synthesis, guayule plants, 506
Polypeptides
membrane-associated, carbon dioxide concentrations, *Chlamydomonas reinhardtii*, 133
phase-specific, cell cycle, *Catharanthus roseus*, 910
Polysaccharides
cell wall metabolism, ripening pear fruit, 1394
pectic fraction, structure of, corn, 792
structure of plant cell walls, sycamore, 421
Potassium
-dependent currents, characterization, corn suspension cells, 1184
low leaf water potential, maintenance, photosynthesis, 1358
mulitphasic uptake, corn roots, 231
Potassium chloride, abscisic acid-induced proline and, barley leaf segments, 1226
Potato
aging of tissue at different temperatures, deposition, aliphatic suberin monomers, 1021
dual-pathway hypothesis, aromatic biosynthesis, 10
freeze-thaw injury, protocol effect, 1372
identification, actively filling sucrose sinks, 1117
mitochondria, monoclonal antibodies, alternative oxidase, 1311
pyrophosphate:fructose-6-phosphate phosphotransferase, product inhibition, 628
tubers and leaves, differential activities,

chorismate mutase isozymes, 472
Primordia, peach flower bud, supercooling, 1031
Proline, abscisic acid-induced, potassium chloride, barley leaf segments, 1226
Protein
import, pea chloroplasts, 993
pathogenesis-related, identification, tomato leaves, 945
$Q_b$, herbicide resistance, tobacco cells, 986
synthesis in mitochondria, cyanide stimulation, castor bean, 669
vegetative storage gene expression, plant sinks, soybean leaves, 309
Protein kinase, activities in tonoplast and plasmalemma membranes, corn roots, 151
Protein phosphatase, thylakoid membrane, wheat chloroplast, 238
Proton
adsorption and copper, corn and soybean root cell walls, 823
-coupled sucrose transport, plasmalemma vesicles, sugar beet leaves, 1318
vanadate-sensitive transport, kinetic analysis, maize root microsomes, 464
Protoplast
corn suspension cells, characterization, potassium-dependent currents, 1184
plant cell, microgravitation effects, electrofusion, 1172
*Prunus persica* (*see* Peach)
*Pseudomonas syringae*, phytopathogenic, exopolysaccharide production, hosts' infected leaves, 5
Pulvini, *Samanea saman*, phospholipid turnover, light-stimulated, 724
Putrescine, hydroxycinnamoylputrescine formation, tobacco cell cultures, 488
Pyrophosphatase, tonoplast adenosine triphosphatase, phenylalanine uptake, barley vacuoles, 1388
Pyrophosphate:fructose-6-phosphate phosphotransferase, product inhibition, potato tuber, 628
*Pyrus communis* (*see* Pear)
Pyruvate,pi dikinase, cold liability, maize, 280
Pyruvate dehydrogenase complex, mitochondrial, regulation of, pea, 1207

**Q**

Quinacrine, temperature effect on plasma membrane, tonoplast ATPases, barley root, 1401

**R**

Raffinose, synthesis in *Chlorella vulgaris*, cold shock, 648
Rapeseed
developing embryos, glucosinolate uptake, 260
3,3-dichloro-2-(dihydroxyphosphinoylmethyl)propenoate, effects on photosynthesis, 1231
endogenous gibberellins, shoot growth, 269
Respiration
chloroplastic, inhibition of, spinach, 1158
freeze-thaw injury, protocol effect, potato, 1372
Rhamnogalacturonan, structure of plant cell walls, sycamore, 421
Ribonucleic acid, messenger
changes in polypeptides during cell cycle, *Catharanthus roseus*, 910
photosynthetic genes of petunia, differential expression, diurnal cycle, 776
time course of induction, salt stress, *Mesembryanthemum crystallinum*, 811
Ribosylzeatin, cytokinin production, *Bradyrhizobium japonicum*, 1247
Ribulose 1,5-bisphosphate
binding to inactive ribulose 1,5-bisphosphate carboxylase, spinach and sunflower, 1253
kinetics of 2-carboxyarabinitol 1-phosphate metabolism, bean, beet and spinach, 174
Ribulose 1,5-bisphosphate carboxylase
activity ratios, carbamylation, bean and spinach, 735
diurnal regulation of activity, bean, beet and spinach, 918
genetic variability, enzyme activities, maize growth, 416
mild water stress, photosynthesis, bean leaves, 1060
Ribulose 1,5-bisphosphate carboxylase/oxygenase
assembly mechanism, delayed osmotic effect, pea, 1366
localization by electrophoretic assay, broad bean, 1088
D-Ribulose-1,5-bisphosphate carboxylase/oxygenase, association with phosphoribulokinase, spinach and pea, 368
Rice
milled grain, sugar content, sucrose metabolism enzymes, 893
red, seed dormancy, 879
scutella, amino acid and peptide uptake, 1285
*Ricinus communis* (*see* Castor bean)
Ripening, tomato genotypes, temporal regulation, polygalacturonase gene expression, 117
Root
apple, indole-3-acetic acid, indole-3-butyric acid, 439
barley
tonoplast, $Na^+/H^+$ exchange activity, 1
tonoplast ATPases, temperature effect, 1401
corn
cell walls, proton and copper adsorption, 823
development, water conducting capacity, 1094
endogenous abscisic acid, light effects, 622
ethanolic fermentation, alcohol dehydrogenase, 1275
ionic currents, indoleacetic acid, 1198
localization, $H^+$-ATPase, 391
malate, NMR study, 197
multiphasic uptake of potassium, 231
nucleotides, $^{31}$P-NMR and HPLC, 963
protein kinase activities, 151
vanadate-sensitive ATPase, measurement methods, 867
vanadate-sensitive proton transport, kinetic analysis, 464
cotton, nutrient stress, hydraulic conductivity, 264
oat, plasma membrane, fusicoccin binding protein, 250
soybean
cell walls, proton and copper adsorption, 823
endomembrane glycoproteins, 299
wheat, synthesis, freezing tolerance proteins, 577
Rooting, chrysanthemums, role of ethylene, low oxygen tensions, 165
Rose, auxin antagonism, xyloglucan oligosaccharides, 883
Rosmarinic acid, -producing cell cultures, aromatic amino acid pools, *Anchusa officinalis*, 429
Rubisco (*see* Ribulose 1,5-bisphosphate carboxylase/oxygenase)

**S**

*Saccharum officinarum*, *Saintpaulia ionantha* and, cold-induced low-waves, chlorophyll fluorescence transients, 740
Salt
stress
ferredoxin-$NADP^+$ reductase expression, *Mesembryanthemum crstallinum*, 817
mRNA induction time course, *Mesembryanthemum crystallinum*, 811
tolerance, combined nitrogen, cyanobacteria, 204
-treated millet leaves, fluorescence, delayed light emission, 211
*Samanea saman*, pulvini, phospholipid turnover, light-stimulated, 724
*Sauromatum guttatum*, mitochondria, monoclonal antibodies, alternative oxidase, 1311
*Saxifraga cernua*, thermal acclimation, photosynthetic electron transport, thylakoids, 325
Scutella, germinating grains, amino acid and peptide uptake, 1285
Seed
bean
development of, 333
dynamics of imbibition, 805
corn, glassy state in embryos, 977
cotton, malate synthase aggregation behavior, 352
lectins, bud-specific gene expression, pea, 833
lima bean, sucrose metabolism, 1106
red rice, dormancy of, 879
soybean, water relations, growth and maturation, 610
*Vigna mungo*, cotyledons, sulfhydryl-endopeptidase activation, 274
wheat, germination, thermotolerance, 569
Seedling
mung bean, phototropic reaction, growth retardant, 1085
pea, phytochrome-mediated phototropism, 493
*Selenastrum minutum*, carbon isotope fractionation, ammonium assimilation, 1150
Senescence
development and, cell wall synthesis, tomato fruit, 477
interruption of, norbornadiene, carnation flower petals, 434
$\alpha$-tocopherol accumulation, chlorophyll degradation, various plants, 1028
Shoot, rapeseed, endogenous gibberellins, 269
*Sinapis alba* (*see* Mustard)
*Sinapis arvensis* (*see* Mustard)
Sinks

actively filling, identification of, various plants, 1117
main stem, manipulation of, wheat, 597
vegetative storage protein gene expression, soybean leaves, 309
Sodium
nutrition, chloroplast ultrastructure, $C_4$ plants, 539
stimulated growth of *Amaranthus tricolor*, enhanced nitrate assimilation, 1102
uptake
light-induced proton efflux, cyanobacteria, 1220
membrane vesicles, *Atriplex gmelini*, 180
Sodium chloride, acclimation, plasma membrane characterization, *Dunaliella salina*, 970
*Solanum tuberosum* (*see* Potato)
*Sophora japonica*, specificity for aspartate aminotransferases, 4-substituted glutamic acids, 1122
*Sorghum bicolor*, development of water conducting capacity, root systems, 1094
Soybean
*Bradyrhizobium* symbiosis, $^{31}$P NMR spectroscopic studies, 1238
cold-induced low-waves, chlorophyll fluorescence transients, 740
cyanide metabolism, role for ethylene, 1306
cytokinin antagonist activity, substituted phenethylamines, 564
growth and carbon partitioning, influence, phosphorous nutrition, 225
leaf
phosphate compartmentation, $^{31}$P NMR study, 1331
vegetative storage protein gene expression, 309
maturation of somatic embryos, transition to plantlet growth, 768
partially nitrate-tolerant nodulation mutants, selection, initial characterization, 169
quantification of cytokinin *O*-glucosides, negative ion mass spectrometry, 74
root
cell walls, proton and copper adsorption, 823
endomembrane glycoproteins, 299
seed, water relations, growth and maturation, 610
thermotolerance of isolated mitochondria, heat shock proteins, 617
turgor and growth, low water potentials, 798
use of monoclonal antibodies, purification, sucrose-phosphate synthase, 518
Spearmint, glandular trichomes, localization, monoterpene biosynthesis, 1351
Sphingoid bases, regulation of transplasmalemma electron transport, blue light, oat mesophyll cells, 1345
*Spinacea oleracea* (*see* Spinach)
Spinach
activity ratios, ribulose 1,5-bisphosphate carboxylase, 735
association of rubisco with phosphoribulokinase, 368
changes, dihydroxyacetone phosphate reductase, 305
chloroplast envelope-bound magnesium, chlorotetracycline fluorescence assay, 753
chloroplasts
entry of fructose-2,6-bisphosphate, 1270
light-dependent increase, phosphoglucomutase activity, 557
diurnal regulation, ribulose 1,5-bisphosphate carboxylase activity, 918
freezing tolerance, 444
inhibition of chloroplastic respiration, osmotic dehydration, 1158
kinetics of 2-carboxyarabinitol 1-phosphate metabolism, 174
leaf discs, light effect, chloroplast division cycle, 1178
ribulose 1,5-bisphosphate binding, inactive ribulose 1,5-bisphosphate carboxylase, 1253
stabilization of photosystem II reaction center, polyethylene glycol, 452
use of monoclonal antibodies, purification, sucrose-phosphate synthase, 518
*Spirodela oligorrhiza*, rapid acylation of acyl carrier protein, exogenous fatty acids, 707
Starch
reduced synthesis, mild water stress, bean, 1066
synthesis, *rb* locus, pea embryos, 1279
Stem
cucumber, dynamics, transpiration stream, 643
*Datura* ferox, photomodulation of axis extension, sparse canopies, 1324
pea, elongation, gibberellin, 184
Stomata, mild water stress, photosynthesis, bean leaves, 1060
Stomates, individual, measurements of aperture, broad bean, 387
Suberin, deposition during aging, potato tuber tissue, 1021
Sucrose
identification of actively filling sinks, potato, lima bean and cassava, 1117
metabolism enzymes, sugar content and activity, milled rice grain, 893
metabolism in lima bean seeds, 1106
proton-coupled transport, plasmalemma vesicles, sugar beet leaves, 1318
Sucrose phosphate synthase
light/dark profile, sugar beets, 347
mild water stress in bean plants, reduced starch synthesis, 1066
use of monoclonal antibodies, purification, various plants, 518
Sucrose-P-synthase, genetic variability, differing growth rate, maize plants, 416
Sugar, content and activity, sucrose metabolism enzymes, milled rice grain, 893
Sulfhydryl-endopeptidase, activation, cotyledons, germinating *Vigna mungo* seeds, 274
Sulfur dioxide, alteration of extracellular enzymes, pinto bean leaves, 159
Sunflower
cytokinin antagonist activity, substituted phenethylamines, 564
ribulose 1,5-bisphosphate binding, inactive ribulose 1,5-bisphosphate carboxylase, 1253
Superoxide radicals, generation of, NADH, pea leaf peroxisomes, 728
Sycamore
ATP/ADP-translocator, amyloplast inner-envelope membranes, 1024
structure of plant cell walls, 421
*Symplocarpus foetidus*, mitochondria, monoclonal antibodies, alternative oxidase, 1311

T

Tangerine, *Alternaria alternata* toxin, host-specific effects, mitochondria, 925
Temperature
aging of potato tuber tissue, deposition, aliphatic suberin monomers, 1021
low, photosynthetic electron transport, *Saxifraga cernua*, 325
plasma membrane effect, tonoplast ATPases, barley root, 1401
Tendrils, pea, actin and myosin, 586
Terpenoid, biosynthesis, *Euphorbia lathyris*, 681
Tetrapyrrole, pigment precursors, biosynthesis of, *Chlorella vulgaris*, 852
Thermotolerance
germinating wheat seed, 569
isolated mitochondria, heat shock proteins, soybean, 617
Thylakoid membranes
major light-harvesting chlorophyll *a/b*-protein, mesophyll and bundle sheath cells, maize, 602
pea, photosynthetic apparatus, 932
photosynthetic electron transport, thermal acclimation, *Saxifraga cernua*, 325
phycoerythrin occurrence and localization, *Cycas revoluta*, *Nostac* 7422, 783
protein phosphatase, wheat chloroplast, 238
Tobacco
compensation, mutated auxin biosynthesis gene, 1337
cytokinin antagonist activity, substituted phenethylamines, 564
dual-pathway hypothesis, aromatic biosynthesis, potato, 10
effects of carbohydrate limitation, 457
effects of microgravitation, electrofusion, protoplasts, 1172
ethylene biosynthesis, induction, xylanase, 138
high and low levels of caffeoylputrescine, hydroxycinnamoyl-CoA:putrescine hydroxycinnamoyltransferase, 488
HPLC analysis, polyamines and agmatine, 512
leaf, regulation, catalase activity, 952
leaf explants, arginine decarboxylase, ornithine decarboxylase, 104
mechanism of herbicide resistance, $Q_B$ protein, new mutation, 986
mesophyll protoplasts, photorespiratory properties, 762
mitochondria, monoclonal antibodies, alternative oxidase, 1311
mosaic virus, viral coat protein, reduced photosystem II activity, 111
naphthaleneacetic acid-tolerant mutant, hormonal characterization, immunoenzymic method, 86
senescing organs, $\alpha$-tocopherol accumulation, chlorophyll degradation, 1028
style glycoprotein, pollen-tube growth, 360
$\alpha$-Tocopherol, accumulation in senescing organs, chlorophyll degradation, various plants, 1028
Tomato
cell wall synthesis, development, senescence, 477
genotypes, temporal regulation, polygalacturonase gene expression, 117

hypocotyls, auxin asymmetry, gravitropism, 652
leaf, identification, pathogenesis-related proteins, 945
Tonoplast
adenosine triphosphatase and pyrophosphatase, phenylalanine uptake, barley vacuoles, 1388
barley root
ATPases, temperature effect, 1401
rapid induction, $Na^+/H^+$ exchange activity, 1
corn root, protein kinase activities, 151
oat, ATPase biosynthesis, 1292
Transpiration, stream, dynamics of, cucumber stem, 643
Trichomes, glandular, monoterpene biosynthesis, spearmint, 1351
*Triticum aestivum* (*see* Wheat)
Trypsin, UDP-glucose:(1,3)-β-glucan synthase inactivation, cabbage, 1341
Turgor, growth and, low water potentials, soybean, 798
Tyrosine, *meta*-fluorotyrosine-tolerant cell culture, characterization, *Eschscholtzia californica*, 1299

U

UDP-glucose:(1,3)-β-glucan synthase, inactivation, phospholipases and trypsin, cabbage, 1341
*Ulva lactuca*, phosphorus-31 and nitrogen-14 NMR, uptake, 1389

V

Vacuole
barley, phenylalanine uptake, tonoplast adenosine triphosphatase, 1388
buffer capacities, cytoplasm, *Chara corallina*, 1049
*Catharanthus roseus*, pH regulation, NMR study, 19, 27
enzyme localization, fructan metabolism, Jerusalem artichokes, 658
Vanadate
-sensitive ATPase from maize roots, phospholipid requirements, measurement methods, 867
-sensitive proton transport, kinetic analysis, maize root microsomes, 464
*Vicia faba* (*see* Broad bean)
*Vigna mungo*, cotyledons of seeds, activation, sulfhydryl-endopeptidase, 274
*Vigna radiata* (*see* Mung bean)
*Vinca major*, senescing organs, α-tocopherol accumulation, chlorophyll degradation, 1028
*Vitis vinifera* (*see* Grapevine)

W

Water
conducting capacity development, root systems, corn and other C4 grasses, 1094
dynamics of imbibition, bean seed, 805
dynamics of transpiration stream, cucumber stem, 643
glassy state in corn embryos, 977
relations, growth and maturation, soybean seed, 610
supercooling, peach flower bud primordia, 1031
transport properties, nutrient stress, cotton root cells, 264
Water stress
low potentials, turgor and growth, soybean, 798
maintenance of photosynthesis, wheat, 1358
mild
photosynthesis, bean leaves, 1060
reduced starch synthesis, bean, 1066
Wheat
chloroplast thylakoid protein phosphatase, 238
cold acclimation, synthesis, freezing tolerance proteins, 577
germinating seed, thermotolerance, 569
low leaf water potential, maintenance, photosynthesis, 1358
main stem sink manipulation, 597
scutella, amino acid and peptide uptake, 1285

X

Xylanase, induction of ethylene biosynthesis, tobacco, 138
Xyloglucan, oligosaccharides, auxin antagonism, rose, 883

Z

*Zea mays* (*see* Corn)